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The main players in Mesozoic deformation of the Central European Basin System

M. Scheck-Wenderoth (1), S. Mazur (2)., Y. Maystrenko (1), J. Lamarche (3), U. Bayer (1)

(1)GFZ Potsdam, Telegrafenberg, 14473 Potsdam, e-mail: leni@gfz-potsdam.de, (2) University of Wroclaw, (3) Universite de Provence Marseille

3D structural modelling and seismic interpretation have been performed to clarify the structural relationships between the major zones of deformation within the Permian-Cenozoic sediment fill of the Central European Basin System (CEBS). The CEBS is composed of a series of sub-basins the largest of which are (1) the Norwegian-Danish Basin (2), the North German Basin extending westward into the Southern North Sea and (3) the Polish Basin. Repeated strain localization during the subsidence history of the CEBS was controlled to a large degree by two major families of structures (NW-SE and N-S) respectively with different characteristics on both, the sediment- and the crustal-scale. Another major characteristic of the CEBS is the presence of a thick layer of Upper Permian Zechstein salt, which strongly influenced the Mesozoic structural evolution in terms of mechanical decoupling of its basement from its cover. Structural analysis and calculation of tectonic subsidence have been performed with a 3D structural model containing 6 layers of Permian to Cenozoic deposits and another layer for the crust below the Permian. Complementary, interpretation of newly released seismic data across the southern margin of the basin system and from the central North German Basin (Glückstadt Graben) helped to constrain the timing and mode of Mesozoic deformation. The NW-SE trending Danish and North German basins are bordered by the Sorgenfrei Tornquist Zone, the Mid North Sea-Ringkøbing-Fyn High and the Elbe Fault System whereas the Polish Basin developed along the Teisseyre-Tornquist Zone. In these basins, subsidence prevailed during the Permian and the Mesozoic whereas uplift took place mostly during Late Cretaceous-Early Cenozoic inversion. All the large NW-SE trending fault systems coincide with geophysical discontinuities in the deeper crust, they correlate spatially with old suture zones and may be

domains of reduced-strength inherited from Caledonian and Variscan collision processes. The family of N-S striking elements consists of narrow grabens and troughs (Central Graben, Horn Graben, Glückstadt Graben, Rheinsberg Trough) that were affected by localized subsidence during the Triassic-Jurassic and in parts during the Cenozoic. Seven different steps in the tectonic evolution can be deduced with selective reactivation of the two types of structures. (1) an initial rift phase with most intense volcanic activity along both NW-SE and N-S striking zones, (2) a thermal subsidence phase starting in the Early Permian with deposition of Rotliegend clastics in the NW-SE-oriented North German and Polish basins, (3) ongoing thermal subsidence in the NW-SE-directed North German, Polish and Danish basins during the Late Permian and Mesozoic superposed by extensional tectonics in the Late Triassic-Jurassic with formation of N-S-striking grabens, (4) a Mid-to-Late Jurassic uplift of the central part of the basin system, (5) an Early Cretaceous phase of transtension along the EFS and STZ-TTZ, (6) a phase of inversion of NW-SE striking blocks during Late Cretaceous-Early Cenozoic and (7) a final phase of subsidence in the Cenozoic with mainly N-S striking subsidence centres.